

# A Distributed Rainfall-Runoff Model Applied to Flash Flood Forecasting at National Weather Service Binghamton, NY

## By Michael Schaffner (NOAA/NWS Binghamton, NY)

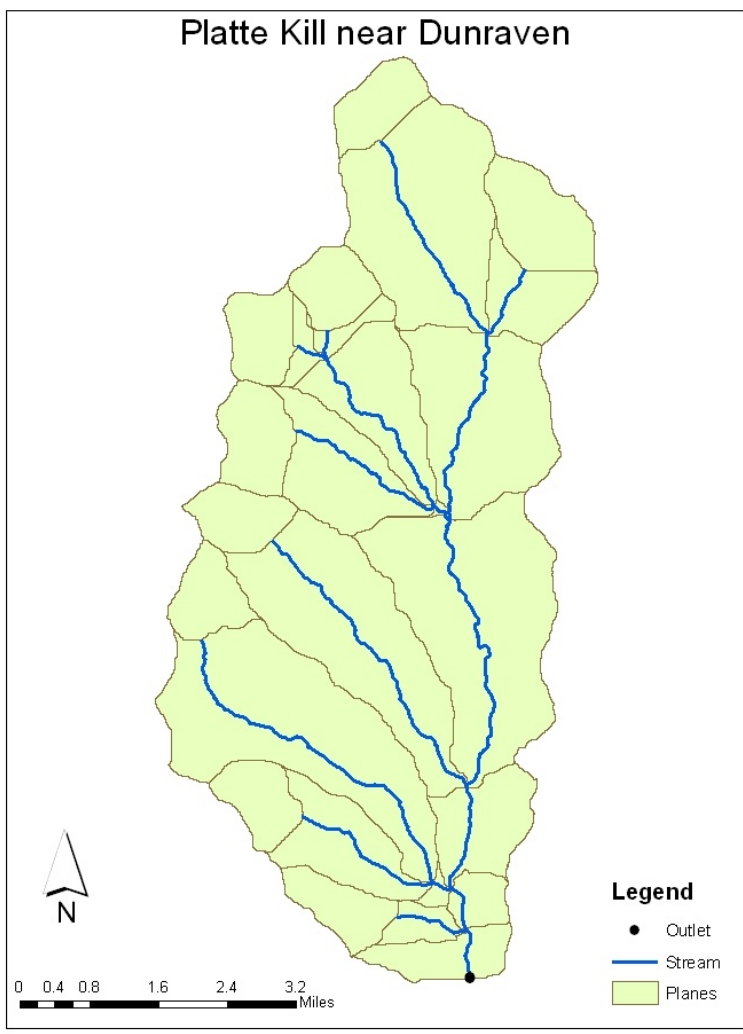
## Carl Unkrich (USDA-ARS Tucson, AZ)

### Overview

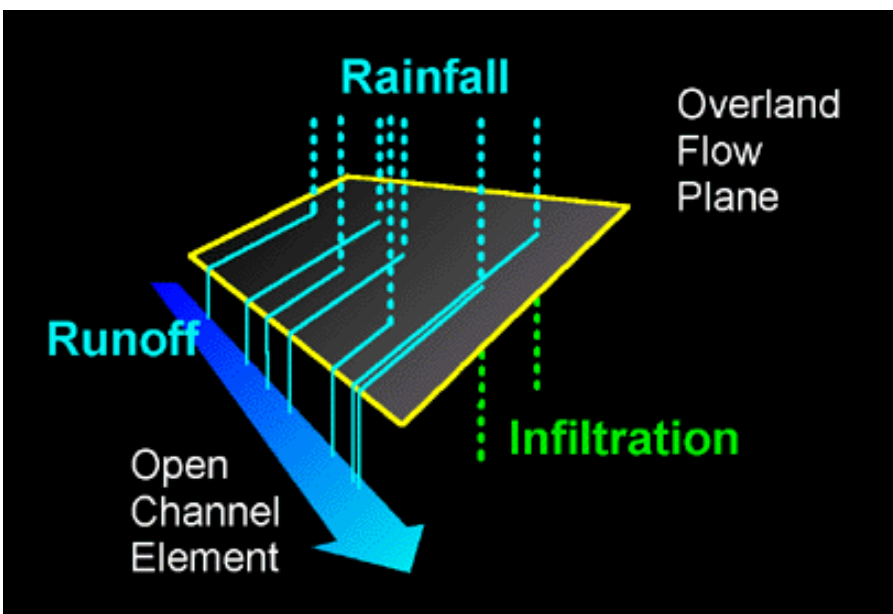
Flash floods pose a significant danger to life and property in the complex terrain of the Binghamton County Warning Area. Of particular concern are the Catskill Mountains which are dissected by numerous hollows which are prone to flash flooding. One effective way to mitigate flood risk is to provide a tool to the Weather Forecast Office that allows the forecaster to effectively predict the timing and magnitude of peak flows in these small watersheds.

The Kinematic Runoff and Erosion Model (KINEROS2) is a spatially distributed watershed model driven by high resolution, Doppler radar-derived rainfall input. Model parameters are derived from high resolution, readily available geospatial datasets including a digital elevation model, land use, and soil characteristics. KINEROS2 runs in a real time mode at the National Weather Service Weather Forecast Office in Binghamton, New York. In this study, KINEROS2 was evaluated for several watersheds in the Catskill Mountains over a timeframe of several warm seasons.

### Model Structure



Plan View

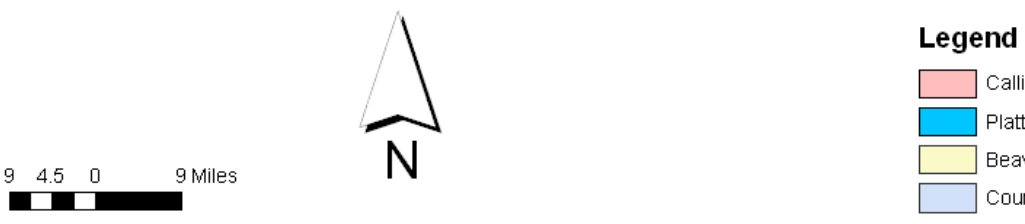
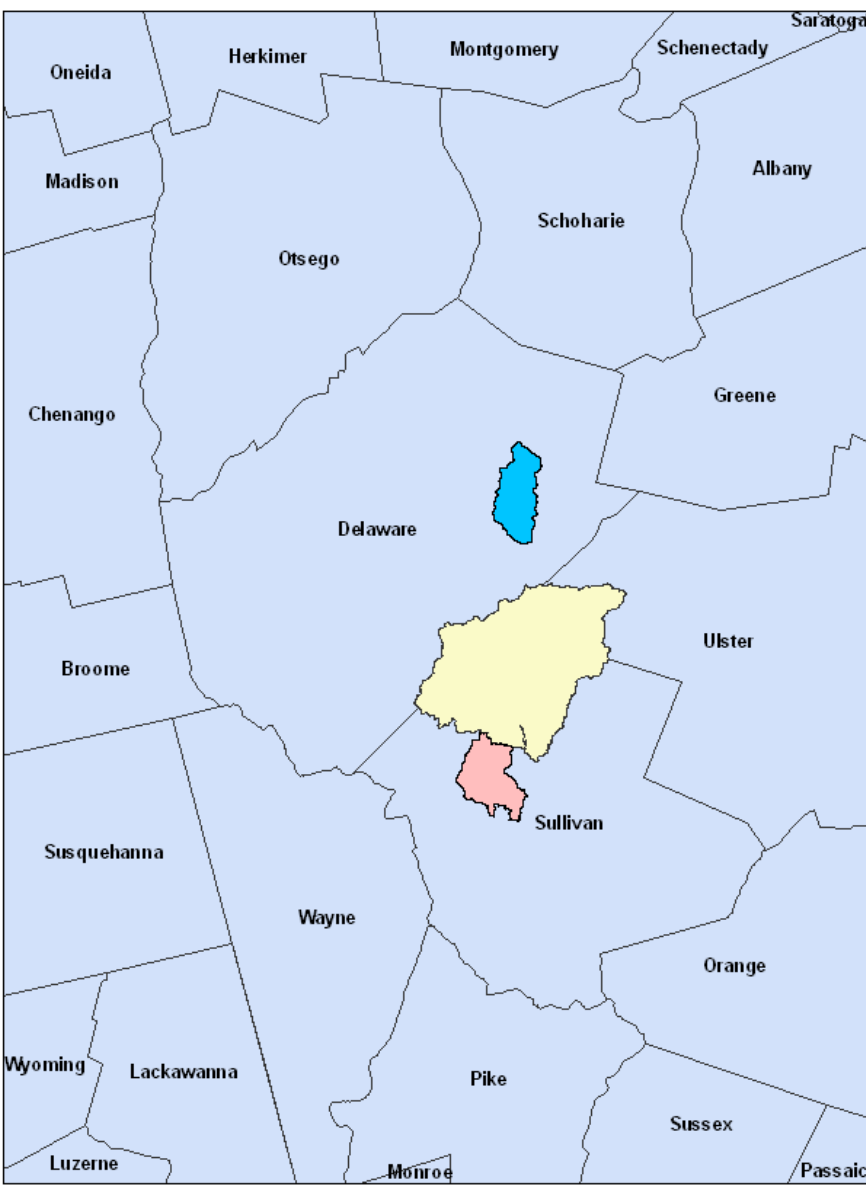


Schematic View

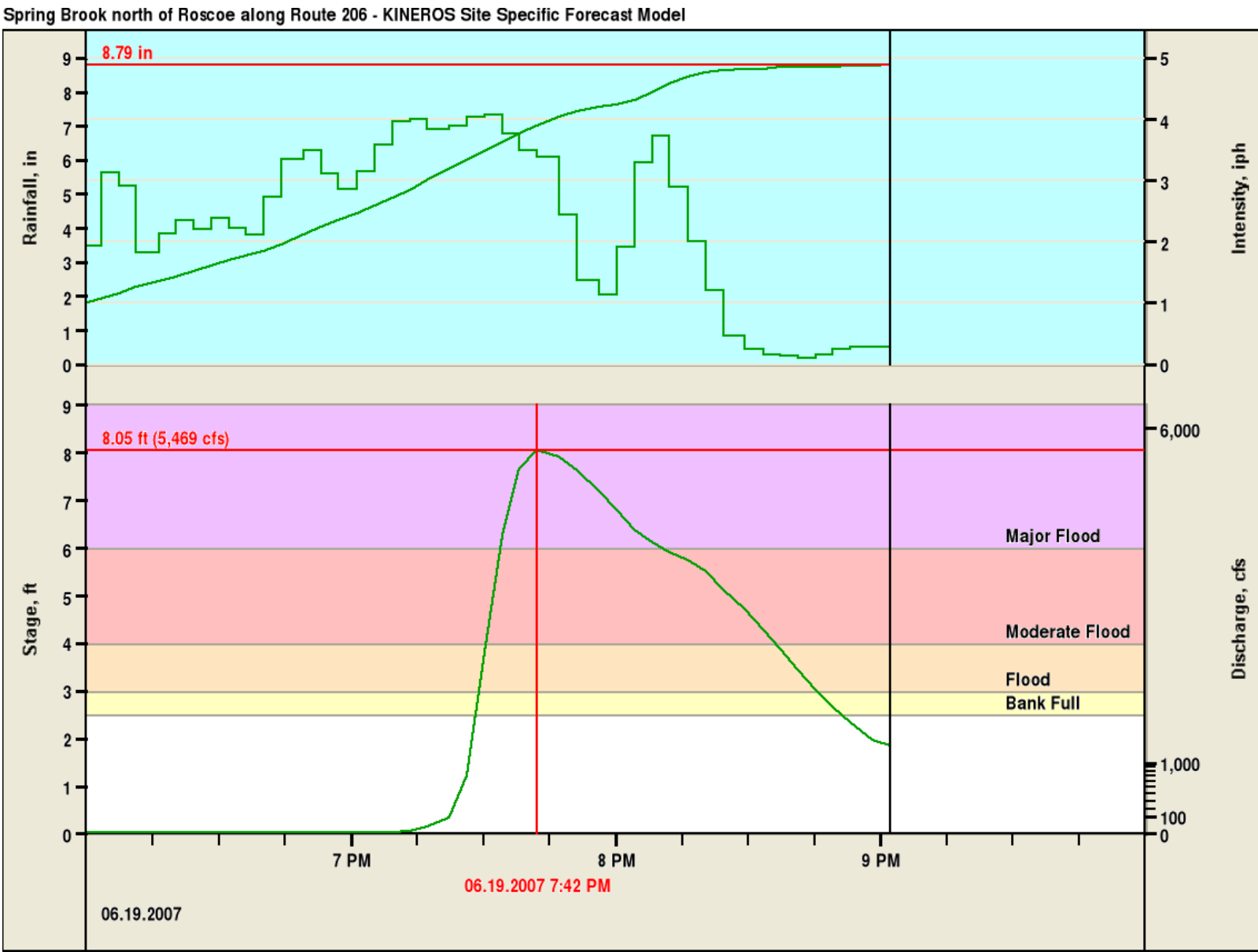
- Is composed of a cascade of overland flow planes and open channel elements.
- Kinematic wave equations route water downstream to the outlet point.

### Study Watersheds

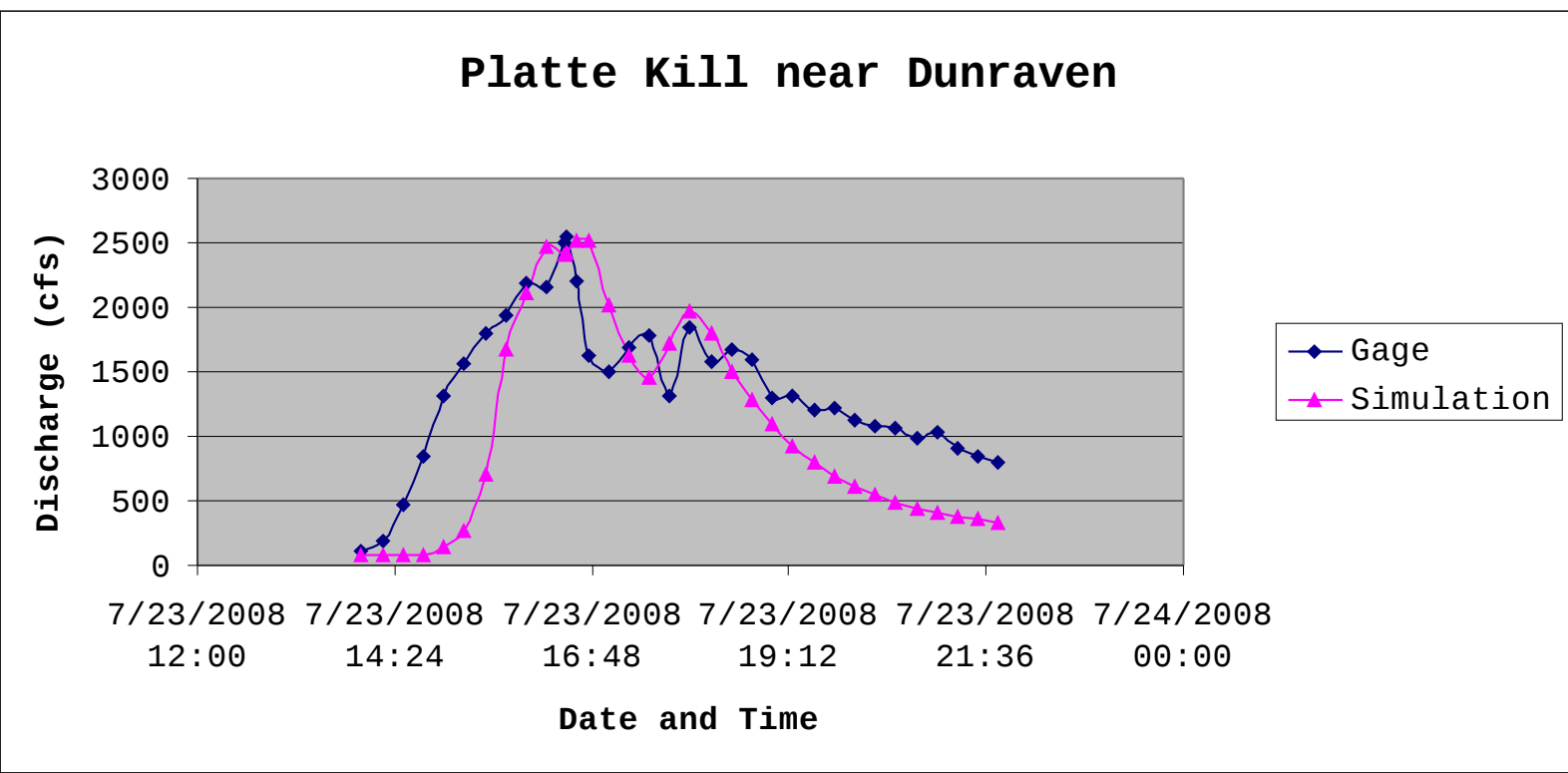
Are located in the Catskill Mountain region of NY. Watersheds range in size from 35 sq mi upwards to 241 sq mi.



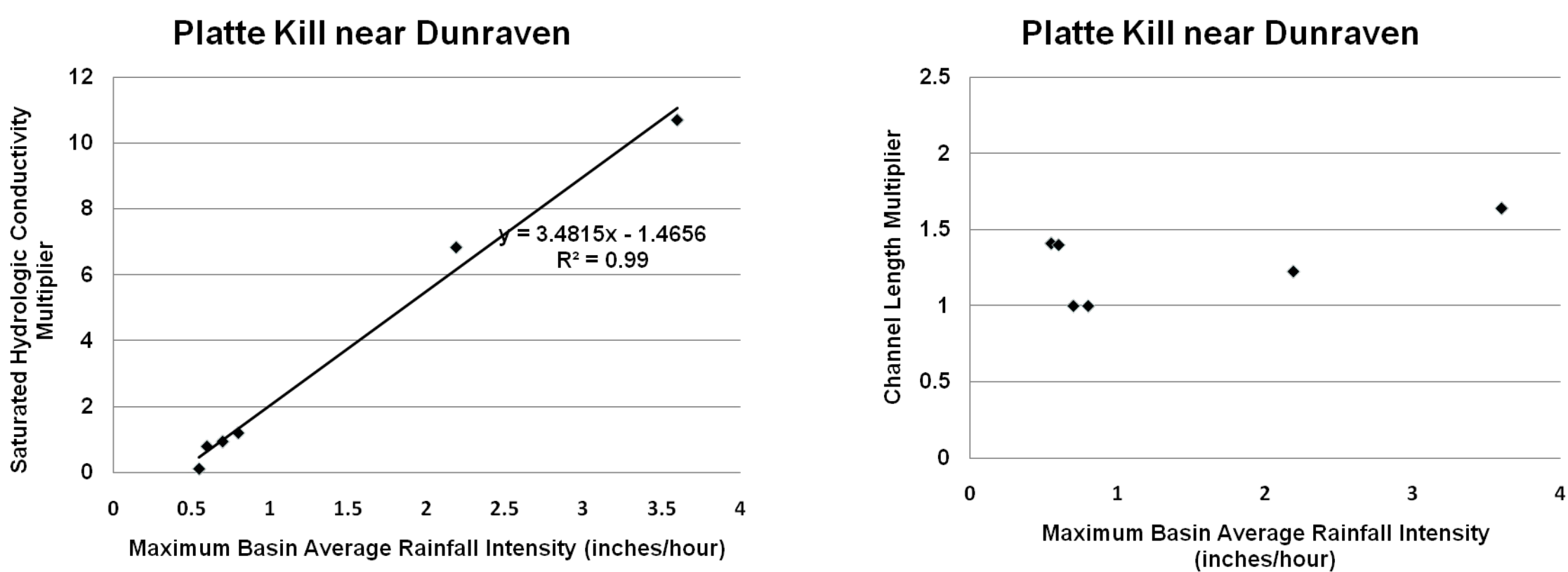
### Graphical User Interface (GUI)



### Platte Kill near Dunraven, NY



Typical Simulation Hydrograph



Calibration Results

### Beaver Kill near Cooks Falls, NY

Local Time	Event
6:45 PM July 29, 2009	KINEROS started.
1:20 AM July 30, 2009	KINEROS forecasts Bankfull to be exceeded.
1:45 AM July 30, 2009	KINEROS forecasts peak flow just below flood stage (9.64 feet / 9,089 cfs) at 6:08 AM.
3:25 AM July 30, 2009	MARFC forecasts crest of 8.8 feet. Need to monitor as it approaches flood stage.
4:30 AM July 30, 2009	Flood stage of 10.0 feet exceeded.
5:11 AM July 30, 2009	MARFC forecasts flood stage momentarily and cresting at 11.0 feet.
5:17 AM July 30, 2009	Flood Warning issued.
5:45 AM July 30, 2009	Flood crest of 10.6 feet / 11,500 cfs.

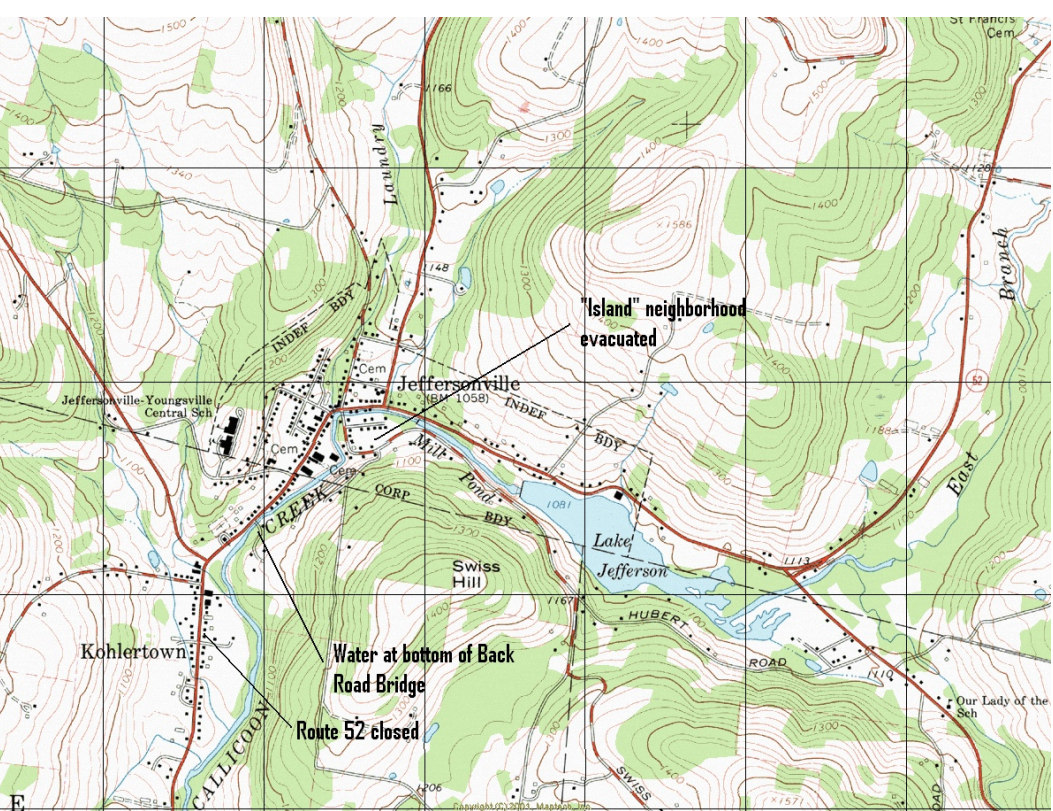
KINEROS2 provides about 2 hours of lead time for flood stage and 3 hours for peak flow determination.

Lead time can be increased with the input of accurate QPF.

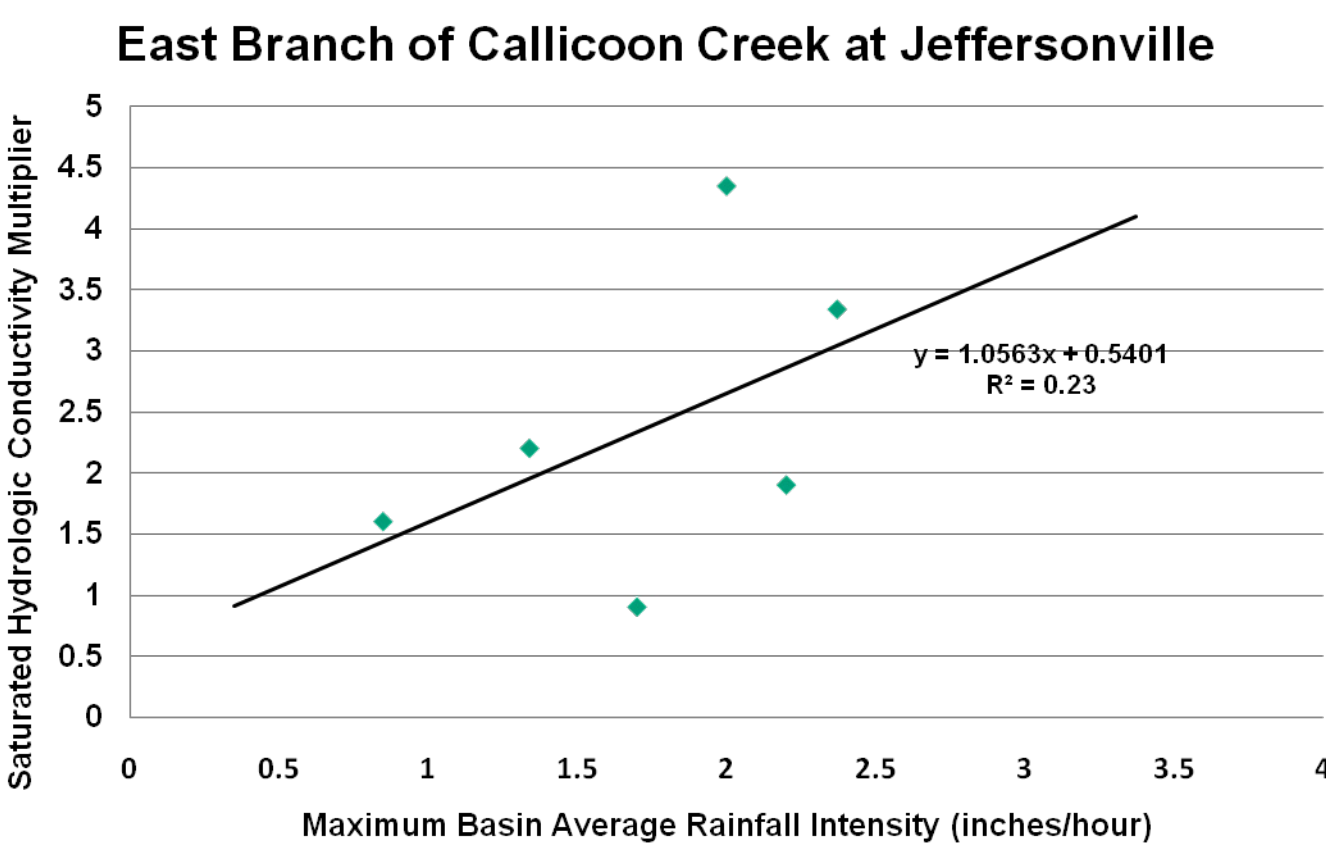
### Modeling in Ungaged Basins

- Represent an under-served area within the NWS.
- Ungaged Basins can be modeled assuming information on magnitude and timing of several events can be collected.

### East Branch Callicoon Creek at Jeffersonville



Event Date	Description
June 28, 2006	Record flood
July 29, 2009	Minor-Moderate
July 31, 2009	Minor-Moderate
August 2, 2009	¼ Bankfull
August 9, 2009	½ Bankfull
August 22, 2009	½ Bankfull



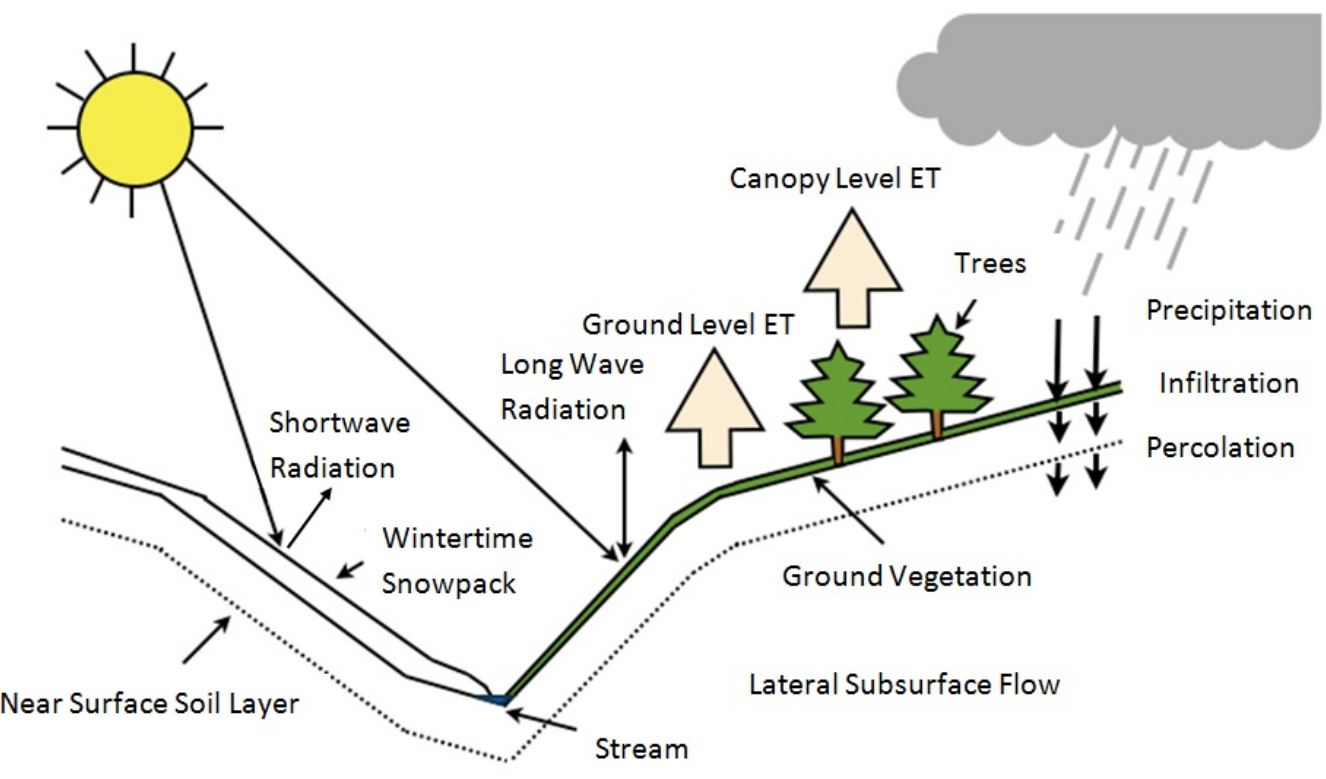
Low R<sup>2</sup> still allows "categorical" forecasting at Jeffersonville.

### Future Enhancements

- Add ability of the user to input QPF.

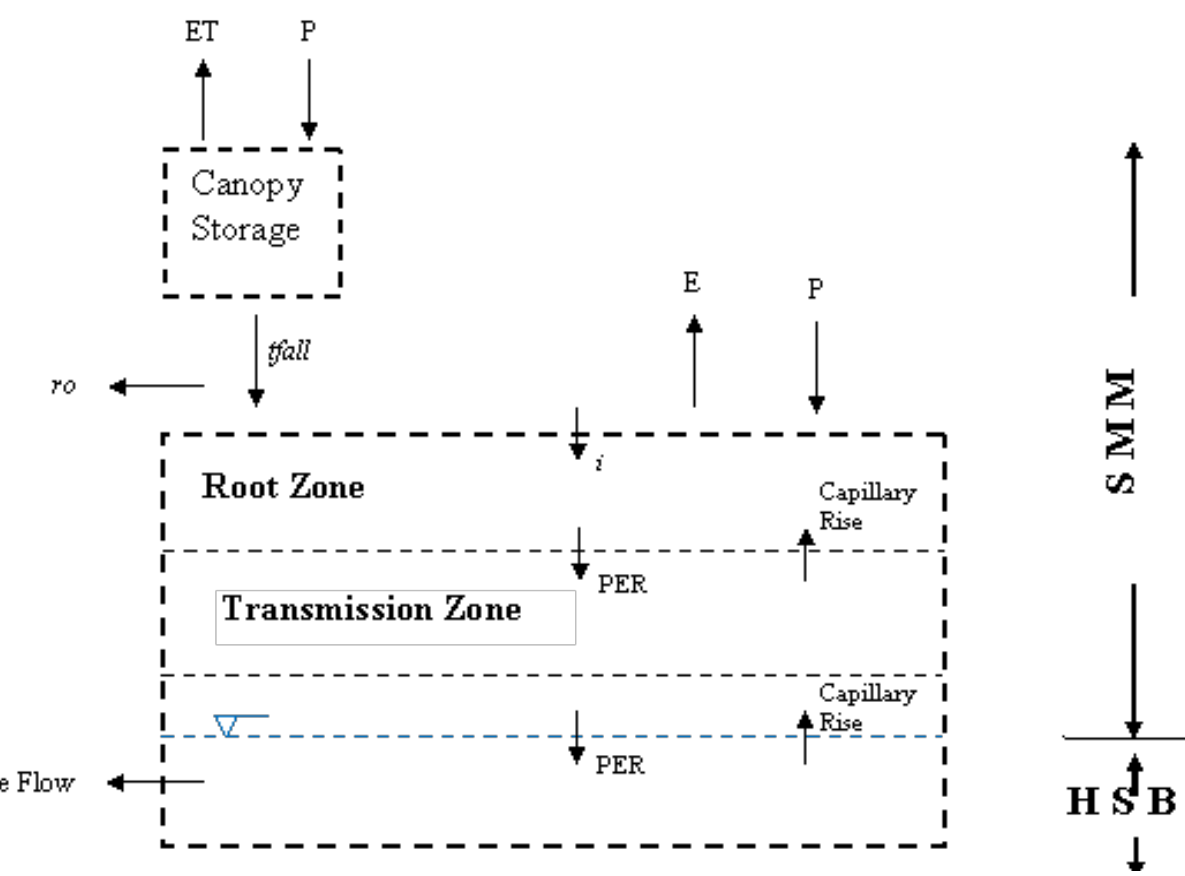
### COMET Partner's Grant

Partnership with: USDA-ARS, University of Arizona, Penn State, NWS Binghamton, and NWS Tucson.



The COMET grant seeks to couple the following modules with KINEROS2:

- The first module is a distributed water and energy balance model of the vegetation canopy and the land surface.
- Second module is the soil water balance model.
- The third module is based on the hillslope storage operates at the hillslope scale treating lateral saturated subsurface transport of soil water.
- The fourth module to be added will be a snow accumulation and melt module.



### National Evaluation of KINEROS2

- Seeks to test KINEROS at several WFO locations representative of differing climatic and topographic regimes.
- Will be done under the NWS HOSIP program.